C&D TECHNOLOGIES
Power Solutions

Battery Cycle Monitor Plus

Users Manual
BCM2200-NM
BCM2100-NM
BCM2000-NM
Version: 1.30   [02/21/2006]

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Table of Contents

General Information

The Battery Cycle Monitor Plus (BCM Plus) is an electronic device used to monitor the status of a battery string used in an uninterruptible power system (UPS). The BCM Plus is composed of monitoring hardware and software. The monitoring hardware provides the physical interface to the power system and the computing resources. The system software provides monitoring and data logging functions.

The hardware contains primary and secondary power sources, isolated voltage, a current shunt input, an alarm contact, nonvolatile memory, a microprocessor, and an operator interface. The primary power source is utility power and the secondary power source is an internal battery. The internal battery acts as the "UPS" for the BCM Plus.

Data can be retrieved from the BCM Plus locally via the serial communication port or remotely with the modem. See Model Information below to determine if a modem exists.

This manual describes the installation and operation of the BCM Plus. Information is also provided on the accompanying software program. Finally, service information is given to aid the user in diagnosing problems with the BCM Plus.

⚠	Throughout the manual, the alert symbol is used to mark items that are very important to note.

👉	The pointing hand points to hints or 'pointers' that may be useful.

These types of messages appear near items that are especially important to note. Make sure to take advantage of both kinds of notes.

Model Information

The following table lists available models of the BCM Plus. A model number ending in '**NM**' indicates that a modem is not installed. Earlier models of the BCM Plus contained a 2400-baud modem. These model numbers did not have an "NM" suffix. A UL label on the outside of the enclosure will specify which model you have. As of January 2006, the modem has been discontinued but is included in this manual for legacy purposes.

Refer to the <u>Electrical Specifications</u> section in the <u>Appendix</u> for maximum input ratings of each model.

Model Number	Description
BCM02200-NM	750V UPS Model
BCM02100-NM	Telco 48V Model
BCM02000-NM	Telco 24V Model

Table 1: Model Numbers

Hardware Description

The BCM Plus monitoring electronics consists of a main printed circuit board containing the microprocessor, real time clock, power system, RAM, COM port, discharge alarm contacts, two isolated analog input channels, operator interface, and a remote modem option. Refer to the Model Information section of this document to determine if a modem is installed.

The BCM Plus's time clock operates in military time (24-hour day). The BCM Plus does not adjust for daylight savings time. Time and date can be adjusted via the Operator Interface (OPINT).

Main Circuit Card

The main printed circuit board (PCB) contains the monitoring electronics and the terminal blocks for making the connections to the battery string. Figure 1: BCM Plus PCB Diagram on the following page shows the PCB layout.
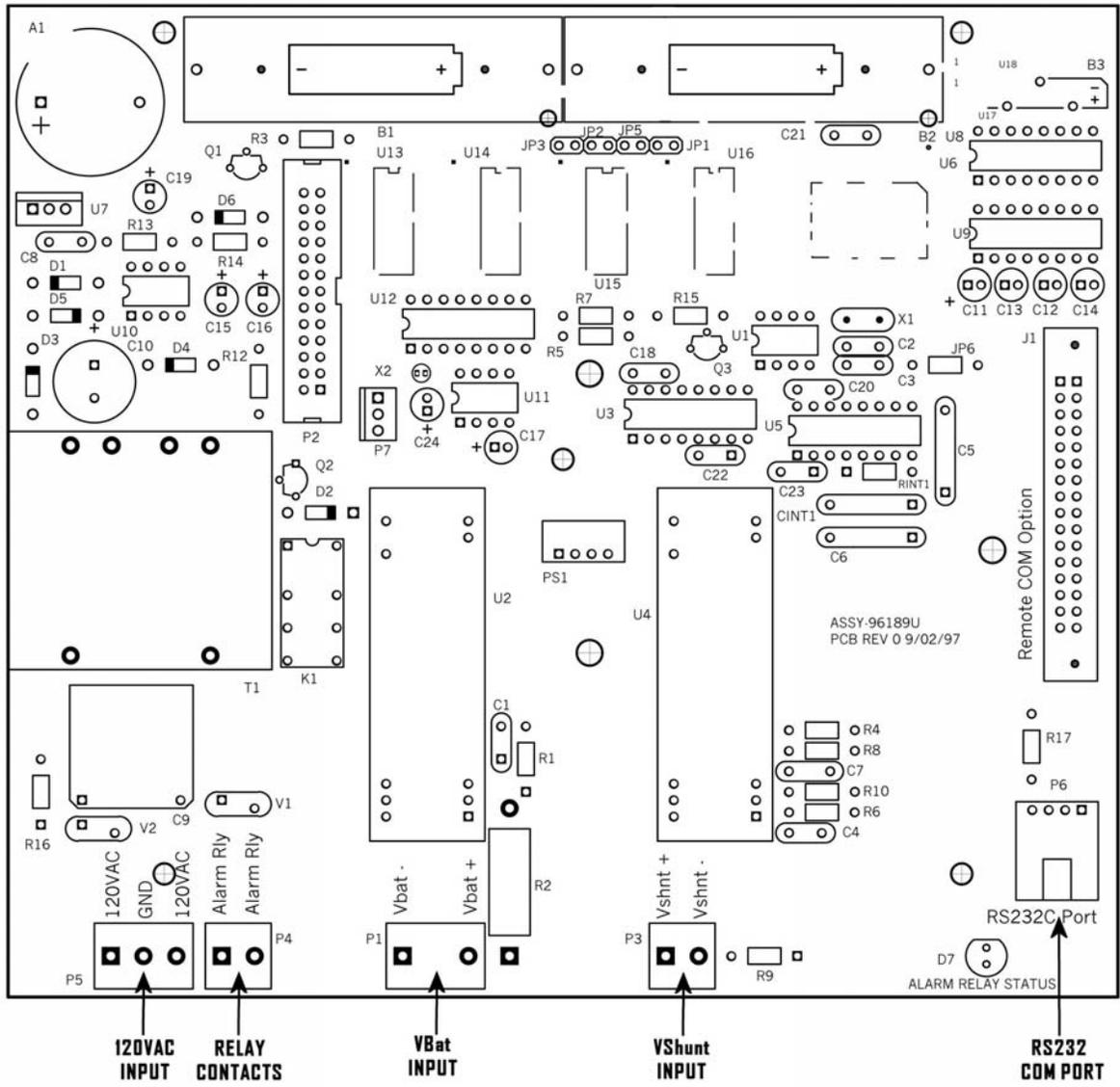
Figure 1: BCM Plus PCB Diagram

Installation

 Do not install lithium batteries until unit is ready to be permanently activated. The BCM Plus has no power switch and becomes active after the batteries are installed. If AC is not applied within 12 hours after the battery installation, the batteries will drain requiring replacement after 200 hours of continuous operation without AC.

The BCM Plus should be mounted according to the instructions below before performing the electrical installation.

The BCM Plus is shipped without the internal batteries installed. They should be installed after the BCM Plus has been installed. The procedure for installing the backup batteries is described in the Service Information section of this document.

Note: Installation should be performed only by trained and qualified personnel.

Mounting

Step	Instruction
1	Unpack the BCM Plus and the special shunt connector from their packing cartons.
2	Select a convenient mounting location allowing for connection of the necessary leads. Either 3 or 4 connections will be required, depending on whether the modem will be utilized: Refer to the Model Information section of this document to determine if a modem is installed. • 115 VAC power connection, either hard-wired or plugged into any unswitched outlet (utility power, not UPS). • Voltage sense leads to the battery string positive and negative terminals. • Current sense leads to the special shunt connector provided. The shunt connector replaces one of the standard connectors and may be installed between any two convenient cells. In some cases, a custom shunt may be provided instead of a standard shunt connector. This custom shunt must be placed in series with battery. • Telephone line to modem if required, plugged into any modular phone jack. Refer to the Model Information section of this document to determine if a modem is installed. The selected location should allow the voltage sense leads to be no longer than 37.5 feet and the current sense leads to be no longer than 25 feet. Allow for slack so the leads can be dressed to the rack later.
3	Mount the BCM Plus by securely clamping the backing plate to a secure support with the clamps provided, tightening firmly with a 7/16" wrench.

Table 2: Mounting Instructions

Electrical Connection

Step	Instruction
4	Disconnect the battery string from the UPS system in accordance with the system manufacturer's recommendations. If this is an operating system, this can usually be achieved by placing the system in "bypass" mode. Since this renders the load susceptible to power interruptions, it is advisable to minimize the risk by having all tools and materials ready to minimize the time on bypass.
5	Temporarily disconnect any intercell or interunit connector to break the voltage across the battery string terminals, before connecting the BCM Plus voltage sense leads.
6	Connect the voltage sense leads to the battery string terminals by placing the loop terminals on the existing bolts (outside of the existing nut) and adding the additional nut provided. Connect the red lead to the positive battery terminal and the white lead to the negative battery terminal.
7	**For C&D batteries,** remove the existing connector from the two cells or units where the shunt connector is to be installed and replace it with the shunt connector. Position the shunt so that the hole closest to the red lead connects to the negative post and the hole closest to the black lead connects to the positive post. Be certain to remove any oxide coatings with a wire brush and to re-tighten the nuts to the designated torque. Where a shunt connector is not available, a commercial shunt is provided that must be installed in series with the battery. C&D recommends that the shunt be installed near the battery termination. The red shunt lead should be connected to the positive side of the shunt (side closest to the negative battery post). The black shunt lead should be connected to the negative side of the shunt.

Table 3: Electrical connections to the battery string.

⚠️ Some battery models are supplied with two connectors per connection. Since all current must flow through a single path for measurement, the second intercell connector should not be installed at the location where the shunt connector is installed.
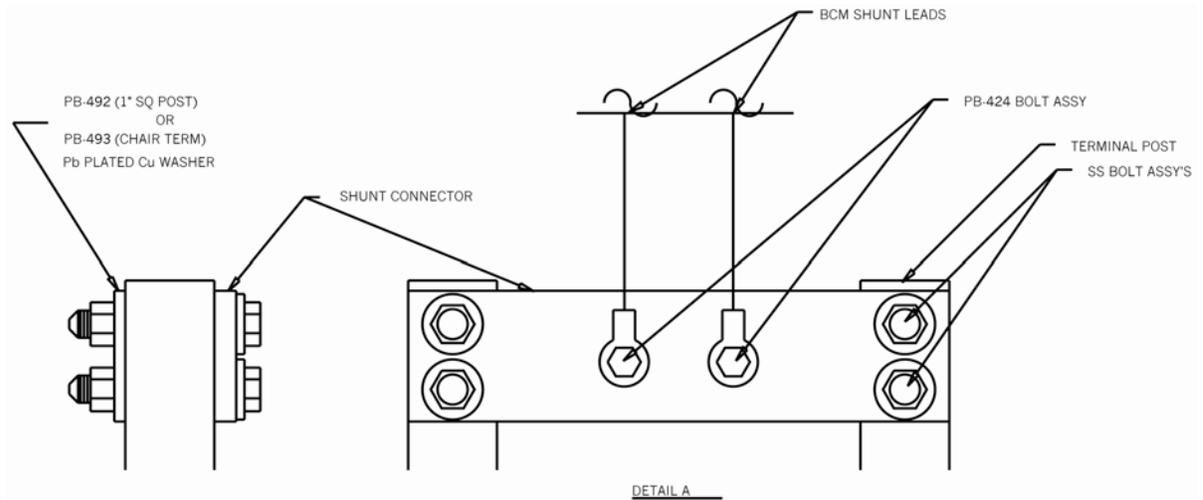
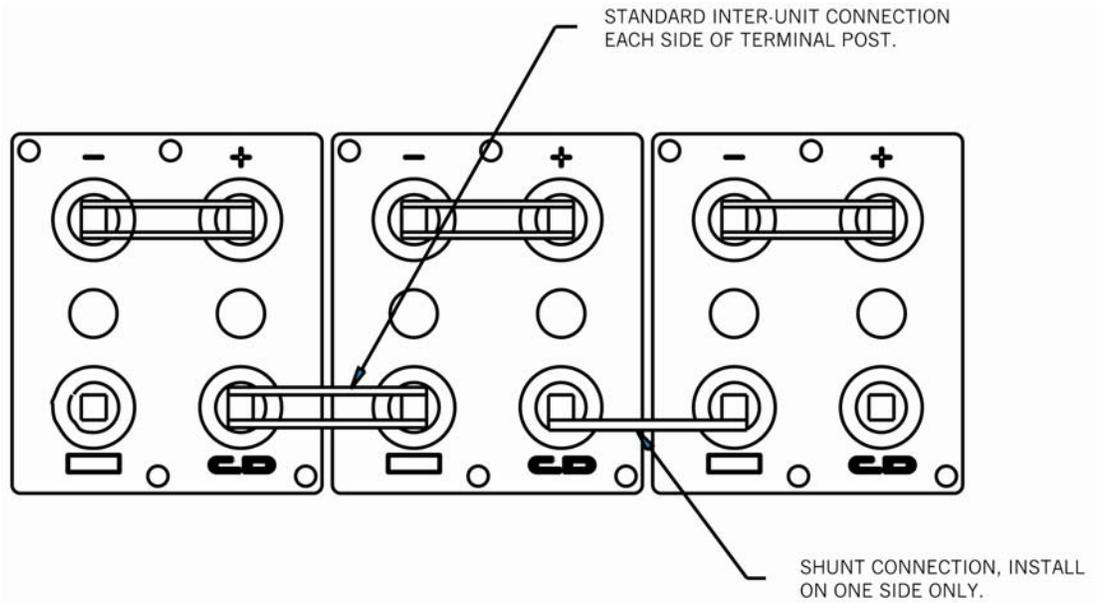Figure 2: Typical current shunt connections.

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Figure 3: Typical current shunt installation.

Do not remove the wire leads from the shunt. Removal of wire leads will uncalibrate the BCM Plus requiring the unit to be shipped back to C&D for recalibration.

⚠️ Each BCM Plus is equipped and programmed for a unique shunt. Ensure that the shunt resistance value written on the shunt matches the shunt resistance value written on the side of the BCM Plus unit.

Step	Instruction
8	Remove the lower cover of the BCM Plus to reveal the connection terminals (see Figure 4: BCM wiring compartment. below).
9	Prepare the voltage and current sense leads for connection to the BCM Plus by cutting to length and stripping the ends for insertion in the BCM Plus terminals. (Allow for some slack so the leads can be dressed to the rack later.)
10	Connect the battery voltage sense leads to the appropriate terminals, connecting the red lead to the positive terminal and the white to the negative. Similarly, connect the shunt leads to the designated terminals, red to positive and black to negative.

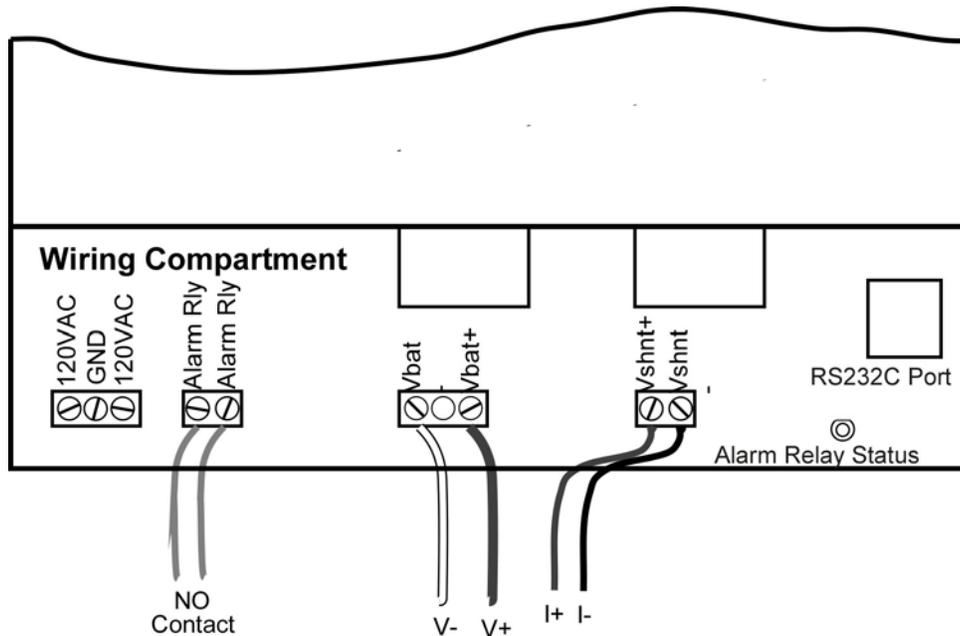**Table 4: Electrical Connections to the BCM Plus.**

Figure 4: BCM wiring compartment.

⚠️ After making the electrical connections, torque all field wiring terminals on the BCM Plus to 5 inch-pounds.

For mechanical protection of the external cables, a conduit may be used for enclosing them. All wires should be routed through the holes at the bottom of the BCM Plus enclosure.

Step	Instruction
11	Detach the front panel from the BCM Plus by removing the four screws located in the corners of the panel.
12	If required, connect the modular (RJ11) telephone cord provided from a telephone jack to the connector on the Remote COM board (see Figure 5: BCM Plus internal compartment. below). It is preferable for the BCM Plus to be connected to a direct line, which can be reached without going through a switchboard, as this will facilitate communication from outside of the facility.
13	When the unit is ready to be permanently activated, install the two 3.6V lithium batteries provided in the battery holder at the top of the unit as shown in Figure 5: BCM Plus internal compartment.. Make sure that the batteries are inserted with the proper polarity or damage to the BCM Plus may occur. See the Service Information section of this document for instructions on replacing the internal backup batteries.
14	Re-attach the front panel.

Table 5: Internal Battery and modem line connections.
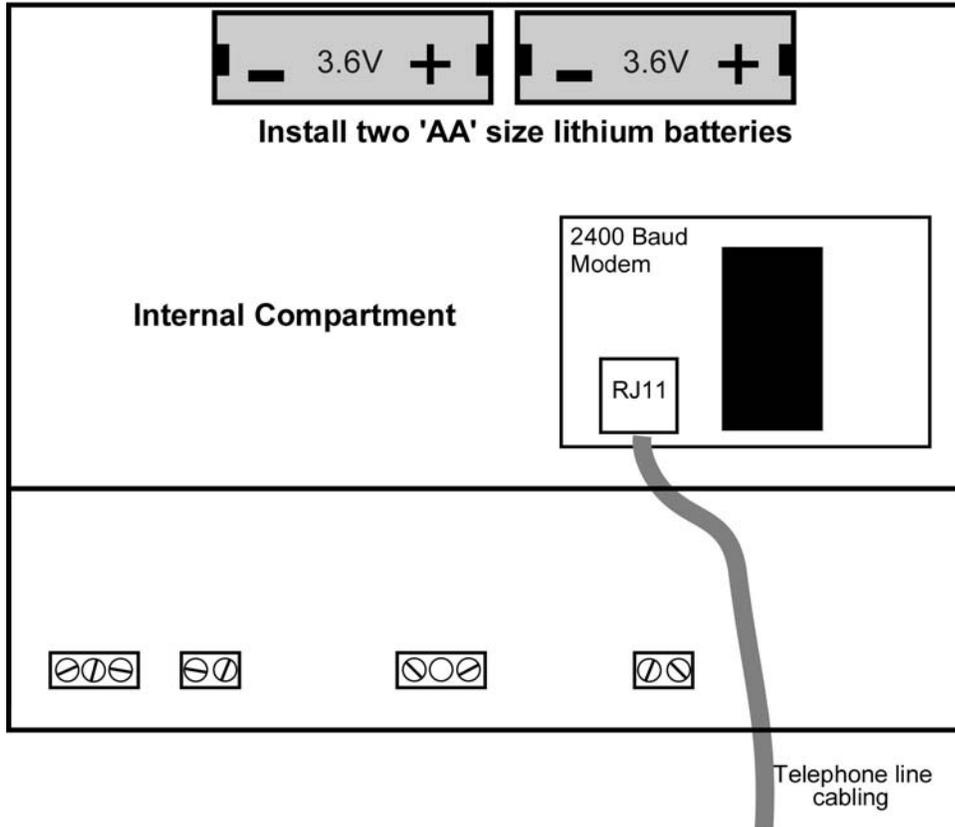
Figure 5: BCM Plus internal compartment.

Do not install lithium batteries until unit is ready to be permanently activated. The BCM Plus has no power switch and becomes active after the batteries are installed. If AC is not applied within 12 hours after the battery installation, the batteries will drain requiring replacement after 200 hours of continuous operation without AC.

Step	Instruction
15	If any user-supplied devices such as bells, lights, etc. are to be wired to the alarm contact, they should be connected at this time. The connection for the alarm contacts is the two position terminal block to the right of the utility power connection (see Figure 4: BCM wiring compartment.). The alarm contacts are closed during an alarm condition. Ensure that the load connected does not exceed the ratings of the contact as given in the specifications.
16	Re-install the lower cover of the BCM Plus case.
17	Reconnect the intercell / interunit connector that was temporarily disconnected in Step 5.
18	Reconnect the battery to the UPS.
19	Plug in the AC power cord of the BCM Plus to an unswitched utility outlet (not UPS).

Table 6: Completing the electrical connections.

The BCM Plus has no power switch and is intended to be powered and monitoring at all times. The internal BCM Plus power is not fused.

Ensure that the device connected to the alarm contacts does not exceed the power specification for the alarm relay.

Operation

This section details the operation of the BCM Plus when connected to a battery string. References are made to Figure 1: BCM Plus PCB Diagram in the Hardware Description section of this document.

Data Logging

During normal operation, the BCM Plus continuously monitors battery string voltage, battery current, ambient temperature, and utility power in order to determine if one or more of these variables is changing. If the magnitude of the change is great enough, it is called an event and the BCM Plus will store information about the event. The table below lists the events that are recorded.

Event	Description
UTILITY LOSS	AC input to the BCM Plus has been lost.
FLOAT	The battery string float voltage is outside nominal range.
DISCHARGE	The UPS system is drawing more than 10% of the battery's rated current.
TEMPERATURE	The ambient temperature is outside nominal range.

Table 7: Basic event types

The information associated with an event is collected and stored in the BCM Plus's nonvolatile memory each time an event occurs. This event recording process continues throughout the life of the BCM Plus. During operation, if no events are occurring the BCM Plus does not store any information in its memory.

When the utility power is disrupted, the BCM Plus continues to operate provided the internal batteries have sufficient capacity. The loss of utility power causes the BCM Plus to perform periodic scans of the input variables rather than continuous scans. This is done so that internal battery life is extended. In addition, data cannot be retrieved from the BCM Plus locally or remotely during the power outage.

The information accumulated in the BCM Plus nonvolatile memory can be extracted for analysis. There are three methods of extracting this information. First, the summary information can be viewed on the display of the operator interface. Second, qualified service personnel may use a portable computer to retrieve the information by connecting to the communication (COM) port and running the proper software. Third, the same process can be performed remotely using a modem. Refer to the Model Information section of this document to determine if a modem is installed.

Alarm Contacts

The alarm contacts are operational only when utility power is available to the BCM Plus. When utility power has failed, the contacts always remain closed. During normal operation with utility power, the contacts are open. The following events cause the alarm contacts to close:

Conditions for Alarm Contacts Closed
UTILITY POWER LOSS.
DISCHARGE event.
FLOAT event.
TEMPERATURE event.

Table 8: Events that close the relay contacts.

The status of the relay contacts is indicated by the Alarm Relay Status LED. The LED is lit green while the contacts are open, and off when the relay is closed. The condition causing the alarm will also be indicated at the top of the operator interface display.

A remote indication of these conditions is possible using the alarm contacts; however, the remote alarm panel should have a means of "silencing" an audible alarm.

Operator Interface

An operator interface (OPINT) comes standard with the unit, which adds a four line by 20 column LCD and a four key keypad. The OPINT functions as a 'host' and is an integral part of the BCM Plus.
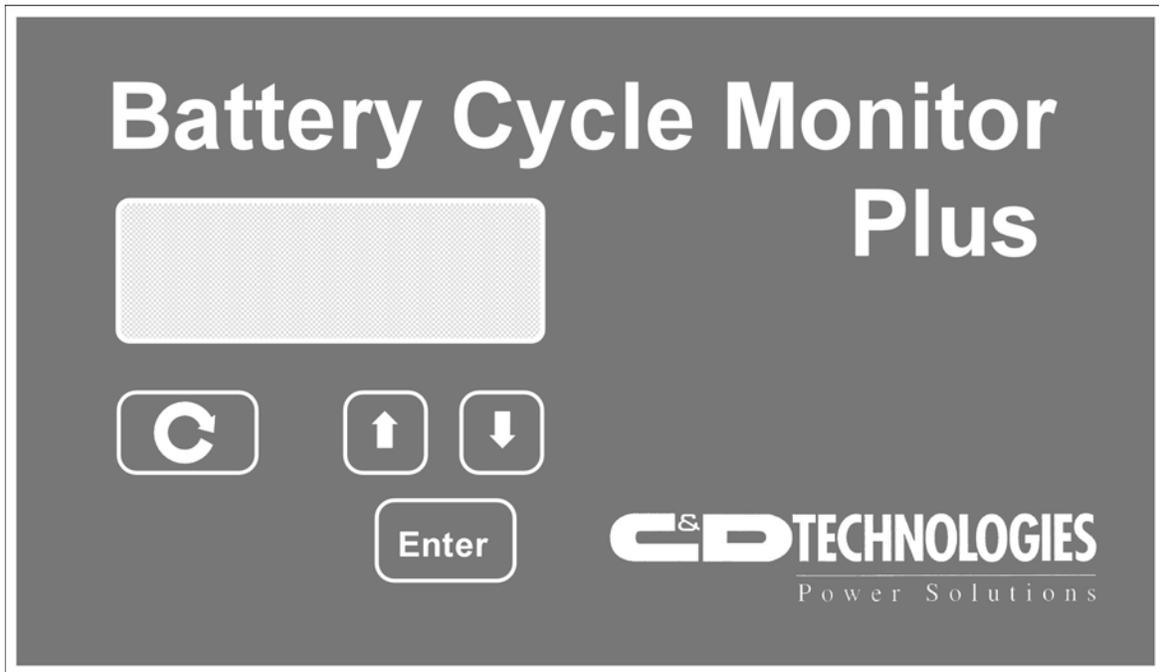
Figure 6: BCM Plus OPINT front panel.

When one of the keys is pressed, the internal audible alarm sounds briefly to acknowledge the key press. If a key is pressed that does not provide a function at the current menu level, a second beep sounds when the key is released.

Key	Action
C	Scroll Key: Allows the user to navigate through a series of menus.
↑ ↓	Arrow Keys: Allow the user to select a submenu item or change the value of a parameter.
Enter	Enter Key: Allows the user to select a menu item or the entry of a parameter.

Table 9: Operator interface key functions.

The keypad is used to navigate the menu structure of the BCM Plus. The table below shows the menu structure and the valid keys that can be used in each menu.

Menu Title	Key	Action
INPUT SCAN: or STATUS:	⟳	Move to next menu item.
MEMORY STATUS:	⟳	Move to next menu item.
SUMMARY REPORT:	⟳	Move to next menu item.
	↑ ↓	Scroll through the Summary Report.
BCM BATTERY:	⟳	Move to next menu item.
CONFIGURATION:	⟳	Move to next menu item.
SET DATE:	⟳	Move to next menu item.
	↑ ↓	Scroll through date.
	Enter	Enter new date.
SET TIME:	⟳	Move to next menu item.
	↑ ↓	Scroll through time.
	Enter	Enter new time.

Table 10: Menu Selections.

Symbols at the upper right corner of the display show the valid key presses for that menu. If any instructions are required, they are listed on the second line of the display.

Menu Title	Description
INPUT SCAN: or STATUS:	Normally, the LCD display will show the date and time, battery string voltage, battery current, and. ambient temperature. During an event, the type of event is indicated and the menu title changes to STATUS:.
MEMORY STATUS:	Displays the status of the BCM Plus's memory usage.
SUMMARY REPORT:	The event summary report can be viewed. The < and > symbols are used to represent minimum and maximum values respectively.
BCM BATTERY:	Displays the voltage and condition of the internal backup batteries. The left most reading is the value under load. The open circuit voltage (Voc) is also displayed. The display will state Batteries are Good, Batteries are Low, or Replace Batteries. When the battery condition is "LOW", only a short life remains.
CONFIGURATION:	Displays the configuration of the BCM Plus including the software revision.
SET DATE:	Allows the user to change the current date displayed on the INPUT SCAN menu.
SET TIME:	Allows the user to change the current time displayed on the INPUT SCAN menu

Table 11: Menu descriptions.

The BCM Plus always scans the input variables while using the OPINT. If the OPINT is left idle in a menu other than the Input Scan display, the BCM Plus will gradually return to this display.

The operator interface is operational only when utility power is available to the BCM Plus. While operating on the internal battery, the operator interface cannot be used.

Remote COM Interface

Earlier models of the BCM Plus contained a 2400-baud modem. The modem has been discontinued but is included in this manual for legacy purposes. Refer to the Model Information section of this document to determine if a modem is installed.

The modem gives the BCM Plus a remote COM port. The modem interface allows access to the BCM Plus from a distant location. It consists of a PCB with the modem electronics and the phone line interface.

The BCM Plus does not scan the input variables while in a modem session. The BCM Plus gives full attention to the modem. If the modem line is left idle in a menu, the BCM Plus will gradually return to a state of no modem session, hang up the phone, and begin scanning the input variables.

The modem also makes remote diagnostics and software updates possible. The modem is operational only when utility power is available to the BCM Plus. While operating on the internal battery, the modem cannot be used.

Service Information

Under normal operation, the BCM Plus does not require service. When the BCM Plus does require service, it alerts the user to problems via an audible alarm inside the enclosure. The following alert signals may occur:

Alarm Sound	Description
Short pulse every 15 seconds.	The internal batteries need to be replaced. See the section below for replacement directions.
Continuous short pulses (less than one sec. apart)	Either the current shunt or the battery string input is not connected.
Continuous tone.	The BCM Plus may be in a reset condition or it may have failed. See the section below, **What to do If...**

Table 12: Audible alarm alert sounds.

Replacing the Internal Batteries

The status of the internal backup batteries can be determined using the menus on the operator interface. The `BCM BATTERY:` menu will display "`Batteries are GOOD.`", "`Batteries are LOW.`", or "`REPLACE Batteries!`"

To replace or install the internal batteries for the first time, follow the following steps and refer to the internal compartment diagram:

Step	Description
1	Remove the front panel located behind the clear hinged cover.
2	Carefully remove the old batteries from the battery holder. NOTE: Do not use a metallic object to remove the batteries. Power is connected to the BCM Plus so there is danger of electrical shock or damage to the BCM Plus caused by a short circuit.
3	Install the two 3.6V lithium size 'AA' batteries in the battery holders. NOTE: Make sure that the batteries are inserted with the proper polarity or damage to the BCM Plus may occur.
4	Replace the front panel.
5	Disconnect the 115VAC connection for approximately 60 seconds and then reconnect. This will update the under load measurement for the internal batteries.
6	Dispose of the old lithium batteries properly.

Table 13: Replacing the internal batteries.

Manufacturer	Part #
Tadiran	TL2100/S
Saft	LS14500

Table 14: Replacement battery part numbers

What to do If...

This table lists some problems that may occur and what should be done to resolve the problem.

Problem	Solution or Items to Check
Continuous alarm tone	Reset the BCM Plus by removing AC power for 10 seconds; then re-apply AC power. If the alarm continues to sound, return the unit to the factory for repair.
Audible alarm sounds briefly at long time intervals	The batteries in the BCM Plus must be replaced. Follow the procedure described in <u>Table 13: Replacing the internal batteries.</u>.
`<low Vbb>` is displayed on the LCD	The batteries in the BCM Plus must be replaced. Follow the procedure described in <u>Table 13: Replacing the internal batteries.</u>
Very little free record space is available	This indicates that the BCM Plus has been recording a significant number of events. Check that the nominal and deviation parameters are set properly for the system by using the Battery Monitor software to download the configuration summary. If uncertain these parameters are correct, consult technical support.
When utility power is restored after an outage the alarm sounds briefly	This is normal during the internal microprocessor initialization sequence.
The audible alarm sounds repeatedly short pulses	One of the inputs to the BCM Plus is not connected or is connected improperly. Check the input connections and verify that they are correct and secure.
Many TEMPERATURE events are occurring.	Check the temperature deviation parameter by using the Battery Monitor software to download the configuration summary. If the parameter is set too low (standard deviation is 10 degrees.). TEMPERATURE events can occur through normal room temperature fluctuation.
The keypad on the operator interface does not respond.	Make sure that there is not a modem or a COM port session in progress. When the BCM Plus is servicing these ports, it is unable to scan the keys to see if one is pressed.

Table 15: Troubleshooting tips

Appendix

Enclosure Specification

Figure 7: BCM Plus enclosure drawing.

Electrical Specifications

Environmental	Minimum	Maximum	Unit
Operating temperature	0	50	°C
Storage temperature	-25	60	°C
Humidity (non-condensing)	15	90	% rel.
Vibration / Shock[1]		<5	G's
Enclosure flammability (Polycarbonate)	UL94V-0		
Power Supply	**Minimum**	**Maximum**	**Unit**
Utility voltage @ 50 to 60 Hz[2]	104	135	VAC
Current draw (not fused)		50	mArms
Ride thru[3]	10		ms @ 115VAC
Isolation voltage	2500		VAC
Acceptable transient[4]		100 - 5	V – µs
Connection		3 pos TB	
Internal battery (2 required)		3.6V Lithium, size AA	
Internal battery replacement cycle[5]	5	>10	years
Internal battery life (normal use)[6]	>200		hours
Discharge Alarm Contact	**Minimum**	**Maximum**	**Unit**
Current		1.0	A
Voltage		126	VAC
Power		24	W
State on alarm condition or loss of utility power		closed	
Connection		2 pos TB	
Data Collection	**Minimum**	**Maximum**	**Unit**
Storage memory	2000	8000	events
Retention time[6]	> 10		years
Sleep time on internal backup power[7]	4.75	5.25	seconds
Scan duty cycle on backup power		<10	%

Table 16: BCM Plus electrical specifications (part1)

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[1]Vibration limit defined as 10Hz to 55Hz at 1.5mm amplitude and 10 cycles. Shock limit < 5G's.

[2]The minimum voltage is the voltage where the BCM will determine that utility power has been lost. Voltages greater than the maximum may damage the unit. Typically the minimum voltage is less than 102 VAC.

[3]Ride thru decreases as voltage or frequency decrease.

[4]Defined as a transient that may occur without damage to the unit.

[5]Under normal conditions, ambient temperature 25°C.

[6]Infrequent power outages less than 20 minutes in duration.

[7]The first scan after power loss is within 2.5 seconds.

Communication Interface[1]	Minimum	Maximum	Unit
Electrical specification		RS232C	
Cable length		50	ft
Connection		3 pin 0.1" IDC	
Baud rate	9600	9600	bps
Parity		none	
Data bits	8	8	bits
Real Time Clock Facility	**Minimum**	**Maximum**	**Unit**
Time parameters	seconds	years	
Accuracy[2]		<2	min/month
Retention time without power[2]	>10		years
Remote Serial Interface	**Minimum**	**Maximum**	**Unit**
Current		125	mADC
Connection		DIN 1/2B	
Operator Interface	**Minimum**	**Maximum**	**Unit**
Display type		LCD	
Display size		4 rows of 20 characters	
Display backlight		LED	
Keys		Scroll, Up, Down and Enter	
Current		125	mADC
Connection		26 pin IDC	

Table 17: BCM Plus electrical specifications (part2)

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[1]Only one serial interface is operable at any instant in time. If using the modem, the local port must be disconnected.

[2]Under normal use, ambient temperature 25°C.

Temperature Sense	Minimum	Maximum	Unit
Range	0	70	°C
Resolution		0.5	°C
25°C error		1.5	°C
Relative accuracy		±2	°C
Battery String Voltage Input (UPS)	**Minimum**	**Maximum**	**Unit**
Input voltage	0.0	750.0	VDC
Resolution		1.00	VDC
Zero error		0.75	VDC
Relative accuracy, V > 100VDC[1]		±2	% of reading
Battery String Voltage Input (48V)	**Minimum**	**Maximum**	**Unit**
Input voltage	0.0	75.0	VDC
Resolution		0.1	VDC
Zero error		0.075	VDC
Relative accuracy, V > 10VDC[1]		±2	% of reading
Battery String Voltage Input (24V)	**Minimum**	**Maximum**	**Unit**
Input voltage	0.0	75.0	VDC
Resolution		0.1	VDC
Zero error		0.075	VDC
Relative accuracy, V > 10VDC[1]		±2	% of reading
Battery String Voltage Input (All)	**Minimum**	**Maximum**	**Unit**
Isolation voltage	±1000		Vpk
Input impedance	1.7	1.9	MΩ
Acceptable transient[2]		100 - 5	V – µs
Connection		2 pos TB	
Cabling	1000		VDC
Cable length[3]		75	ft

Table 18: BCM Plus electrical specifications (part3)

---

[1]Performed via integration, includes area under voltage curve.

[2]Defined as a transient that may occur without damage to the unit.

[3]Combined length of positive and negative leads.

UPS Current Shunt Input	Minimum	Maximum	Unit
Differential mode input voltage	-20.0	+20.0	mVDC
Common mode input voltage	±1000		Vpk
Input span	±10	±20	mVDC
Resolution		0.01	mVDC
Zero error		0.5	% of rated current
Relative accuracy[1]		±8	% of reading
Digital averaging filter depth		2	readings
Isolation voltage	±1000		Vpk
Input impedance	0.95	1.05	kΩ
Acceptable transient[2]		40 - 3	V – µs
Connection		2 pos TB	
Cabling		shielded twisted pair	
Cable length[2]		25	ft

Table 19: BCM Plus electrical specifications (part4)

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[1]Performed via integration, includes area under shunt voltage curve.

[2]Distance from BCM connection to current shunt.

Communications

Communication Port Access

Each BCM Plus has an onboard RS232C communication port. The connection (P6) is located in the right side of the wiring compartment. Included with the BCM Plus is a special four pin to DB9 cable that is required to use the port. The DB9 connector should connect to any standard serial port on an IBM compatible computer.

⚠️ | Connecting to the communication port requires that the BCM Plus wiring compartment be opened. This operation should be performed by qualified service personnel only. High voltages are exposed within the compartment.

The COM port is used for communication between a BCM Plus and a host computer. The COM port is a standard RS232C port that supports transmit data, receive data, and signal ground. The user can run the supplied ***Battery Monitor*** software to access the BCM Plus. The communication port is operational only when utility power is available to the BCM Plus. The communication port does not need to be permanently wired unless the port is used frequently.

Remote COM

An expansion slot on the BCM Plus main PCB allowed a remote communication option to be installed. Refer to the Model Information section of this document to determine if a modem is installed. Refer to the Installation section Table 5: Internal Battery and modem line connections. for proper instructions to connect the telephone line to the modem.

⚠️ | Installing or connecting to the Remote COM port requires that the BCM Plus internal compartment be opened. This operation should be performed by qualified service personnel only.

2400 Baud Modem

When the modem is installed, the BCM Plus answers a phone ring automatically and provides remote access to the BCM Plus information. To utilize the modem, a computer with a Hayes™ compatible modem is required at the remote location. The remote user can run the supplied ***Battery Monitor*** software to access the BCM Plus. The same downloadable information described in the Communication Port Access section is also available remotely.

Field Installation

The modem consists of a single printed circuit board that plugs into the Remote COM expansion slot on the main PCB. The BCM Plus automatically recognizes the

presence of the modem and executes program code to utilize the modem if present. To install the modem, follow the following steps:

Step	Description
1	Remove 115VAC power from the BCM Plus. NOTE: The BCM Plus continues to operate on the secondary power supply while the modem is installed. Be sure to leave the circuit undisturbed.
2	Remove the front panel located behind the clear hinged cover of the enclosure.
3	Connect the phone cable to the jack on the modem PCB.
4	Route the phone cable through the far right access hole at the bottom of the enclosure.
5	Replace the front panel.
6	Reconnect 115VAC power to the BCM Plus.

Table 20: Steps for modem installation.

Type of Service
The BCM Plus modem is designed to use standard device telephone lines. It connects to the telephone line by means of a standard jack called the USOC RJ11C. Connection to telephone company-provided coin service (central office implemented systems) is prohibited. Connection to party lines service is subject to state tariffs.

Telephone Company Procedures
The goal of the telephone company is to provide you with the best service it can. In order to do this, it may occasionally be necessary for them to make changes in their equipment, operations, or procedures. If these changes could affect your service or the operation of your equipment, the telephone company will give you notice, in writing, to allow you to make any changes necessary to maintain uninterrupted service.

If you have any questions about your telephone service, such as how many pieces of equipment you can connect to it, the telephone company will provide this information on request.

In certain circumstances, the telephone company may request information from you concerning the equipment that you have connected to your telephone line.

Upon request of the telephone company, provide the FCC registration number and the ringer equivalence number (REN) of the equipment that is connected to your line. The sum of all the REN's on your telephone lines should be less than five in order to assure proper service from the telephone company. In some cases, a sum of five may not be usable on a given line.

If Problems Arise
If any of your telephone equipment is not operating properly, you should immediately remove it from your telephone line, as it may cause harm to the telephone network. If the telephone company notes a problem, they may temporarily discontinue service. When practical, they will notify you in advance of this disconnection. If

advance notice is not feasible, you will be notified as soon as possible. When you are notified, you will be given the opportunity to correct the problem and be informed of your right to file a complaint with the FCC.

In the event repairs are ever needed on the BCM Plus modem, they should be performed by the factory only.

BCM Plus Configuration

Programmable Parameters

The programmable parameters are listed in the configuration summary report. These parameters determine the BCM Plus's operation. Primarily, they tell the BCM Plus when to consider a change from nominal a recordable event. They are factory preset and require no user input for proper operation. To change a parameter, please contact C&D technical support. The parameters are listed in the table below.

Name	Description
Nominal link Voltage	This is the normal battery string float voltage.
Float deviation	When the battery string voltage differs from nominal by more than this deviation value, the BCM Plus considers a FLOAT event to be in progress. Float deviation is also a factor in a DISCHARGE event.
Rated current	This is the rated current of the system.
Discharge deviation	When the shunt current is less than zero by this amount and the battery string voltage is lower than nominal by the float deviation, the BCM Plus considers a DISCHARGE event in progress. The discharge deviation must be greater than zero.
Rated power	This is the rated power of the system.
Power deviation	During a DISCHARGE event, if the power changes by this amount the BCM Plus will record a new event. The value must be greater than 2% of rated power.
Nominal Temperature	This is the normal ambient temperature rating in degrees Fahrenheit.
Temperature Deviation	When the temperature changes from nominal by greater than this amount, the BCM Plus considers a temperature event to be in progress. The temperature event will end when the measured temperature returns to within ±4 °F.

Table 21: Programmable parameters.

Startup Parameters

The configuration summary report also lists the eight startup parameters for the BCM Plus and the date the `Invoice #` was set. The startup parameters are described in the table below. They are factory preset and require no user input for proper operation. To change a parameter, please contact C&D technical support. The parameters are listed in the table below.

Name	Description
Customer name	Your name. (12 characters)
Rep #	The representative number for the UPS. (10 characters)
Customer #	Your customer number. (10 characters)
Serial number	The serial number of the BCM Plus. (5 characters)
Cell type	The type of cells used in the UPS. (12 characters)
Cell quantity	The number of cells in the UPS. (numerical value)
Shunt #	The number of the shunt connector used in the UPS. (8 characters)
Warranty type	Type of warranty on the UPS. (8 characters)

Table 22: The startup parameters.

Battery Monitor Software Installation

The Battery Monitor program is a windows based program that allows for the following:

- Downloading configuration information from a BCM Plus.

- Downloading event record data from a BCM Plus.

- Downloading event record summary information from a BCM Plus.

- Reviewing data retrieved from a BCM Plus.

Requirements for Installation

Battery Monitor software is designed to run on IBM and compatible computers. The following items are required (starred items needed only for remote operation):

Item	Description
1	PC with 300 megahertz (MHz) or higher processor clock speed recommended; 233-MHz minimum required. Intel Pentium/Celeron family, AMD K6/Athlon/Duron family, or compatible processor recommended
2	Microsoft Windows XP
3	A hard disk with at least 5 MB of free space.
4	An available serial port (COM1 – COM8).
5*	(If installed) A modem and cable. The modem must be at least 2400 baud.
6*	(If installed) A phone line for the modem.

Table 23: Items needed for installation.

Installing **Battery Monitor Software**

When installing the Battery Monitor Software on Windows XP you must have administrator rights for the PC. If you do not have administrator rights, the program will not function properly.

Follow these steps in installing the Battery Monitor Software:

Step	Instruction
1	Place the setup CD in the CD drive of your computer.
2	The setup program should autorun. If it does not, go to the **START** menu and choose **RUN**. Then browse to your CD drive and select the "SetupBatteryMonitor.exe" file. Then press OK.
3	Once the installation process begins, follow the instructions on the dialog boxes.
4	Once complete you may run the program by choosing it from your **START** menu.

Table 24: Battery Monitor installation.

Uninstalling **Battery Monitor Software**

Follow these steps in uninstalling the Battery Monitor software:

Step	Instruction
1	Navigate to the Control Panel and open "**Add or Remove Programs**"
2	Choose Battery Monitor from the list of programs.
3	Press the "**Change/Remove**" button and follow the instructions.

Table 25: Battery Monitor removal

Battery Monitor Operation

Introduction

When using the C&D Battery Monitor Software for the first time, a window will appear to advise you that you need to select communications settings. In order to communicate with a Battery Cycle Monitor (BCM) device, you will need to select the communication port on your computer that will be used.

Unless you would like to change your settings later, you will not be prompted for this information again. Once the communications port is selected, and optionally the remote telephone number to use if a modem was selected, the settings are saved for future use.

Settings

Select the [Communications] button on the left control panel to invoke the communications settings options, as shown in this image:
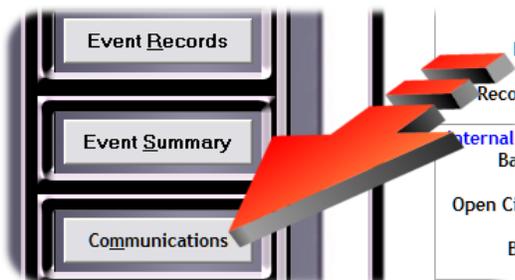
Communications Port:
This selection allows you to perform changes to the communications port on your computer that the software uses to communicate with the BCM.

The serial communications ports will be shown in a drop down list, and show only those ports that are available on your computer.

Each computer may have differing numbers of communications ports available. Some communications ports will be shown that use a modem, others will use the 9-pin serial port on the back of the computer.

Connection Method:
There are two methods used in order to communicate with the BCM. If you are using the standard communications cable between your computer and the BCM, simply click on the "Local (without Modem)" button. This is the default operation mode and should already be selected for you.

If you are using the software to communicate with a remote BCM via a modem, select "Remote (With Modem)". The system will tell you on which port it has located a modem.

Modem Parameters:

If you have selected the "Remote (With Modem)" option there will be two fields that must have data entered.

First, enter the telephone number of the remote modem.
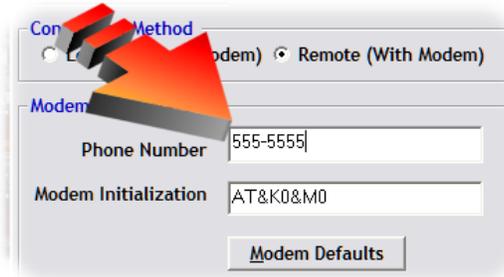
The second field should already be populated. Leave this information intact unless you need to use special codes for modem initialization.

Use the default modem initialization string that comes with the software unless you have a non-standard modem, such as those found on some Dell computers. In this case, you need to consult your computer's owners manual to locate the modem initialization strings to perform the following:

1. **Data Compression Disabled (an alternate for &K0)**

2. **Disable error correction (an alternate for &M0)**

If you make a mistake, simply click the "Modem Defaults" button, which will restore the normal parameters for modem control. Press the "Update" button to save your changes or the "Cancel" button to ignore any changes.

Refresh Status:

The Battery Monitor status information is only updated when the "Refresh Status" button is pressed. The data does not update dynamically on this feature.
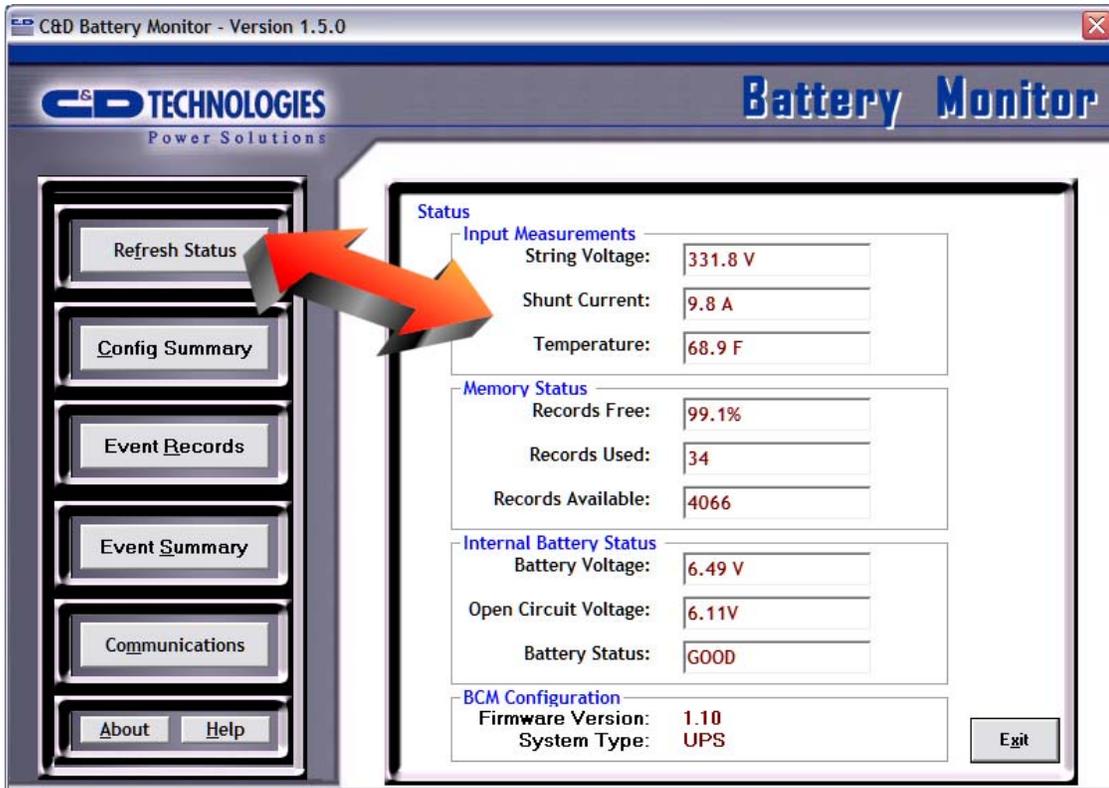
A "Refreshing" screen will appear while the BCM's status information is being read:
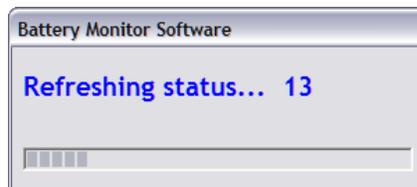
Configuration Summary:

This selection will launch a new window and query the BCM for the summary of the system's configuration. The time needed to collect the information for the event summary will vary depending on whether you are using a modem or are directly connected to the BCM.
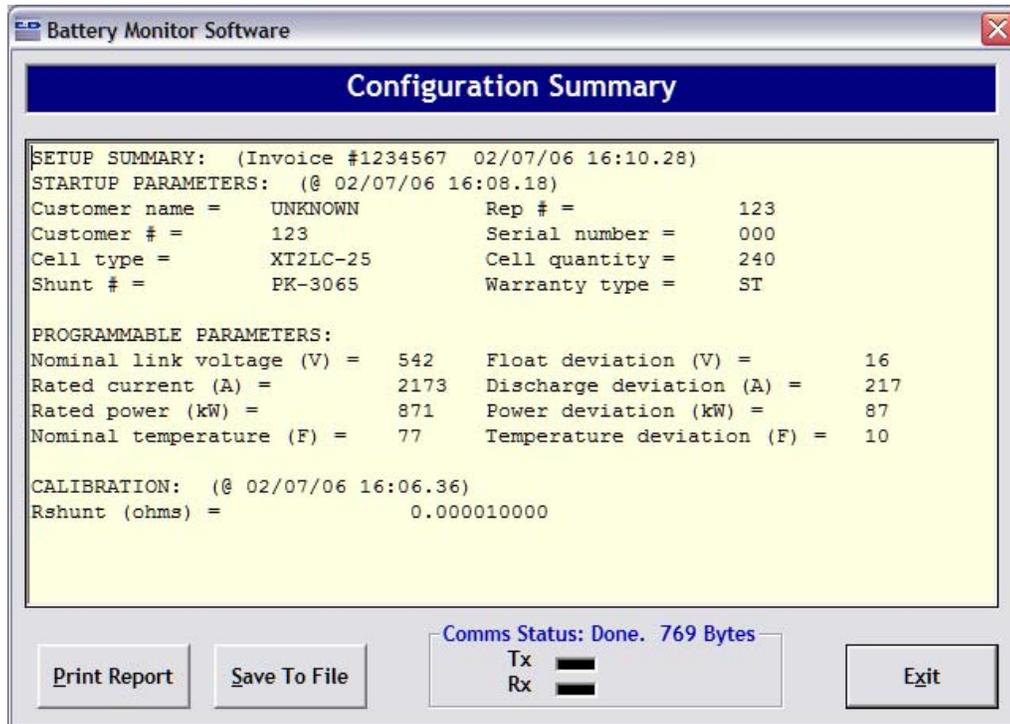
While the software is performing the query to the BCM, two graphical LED's will show the status of the communications between the computer and the BCM.
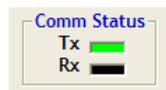

The summary screen can also be saved to any directory on your local computer or local area network.

The "Print Report" button is used to capture this report to any printer that you select.

If you are experiencing communications problems with this option, you should note that the Tx and Rx indicators will be red in color, and "Comms Status" will show "Error", as shown here:
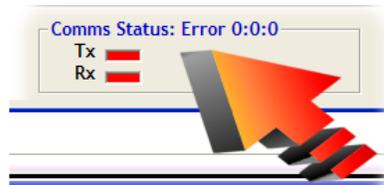
Refer to the communications troubleshooting section for this condition.

Event Summary:

This selection will launch a new window and query the BCM for the summary of technical events. The time needed to collect the information for the event summary will vary depending on whether you are using a modem or are directly connected to the BCM.
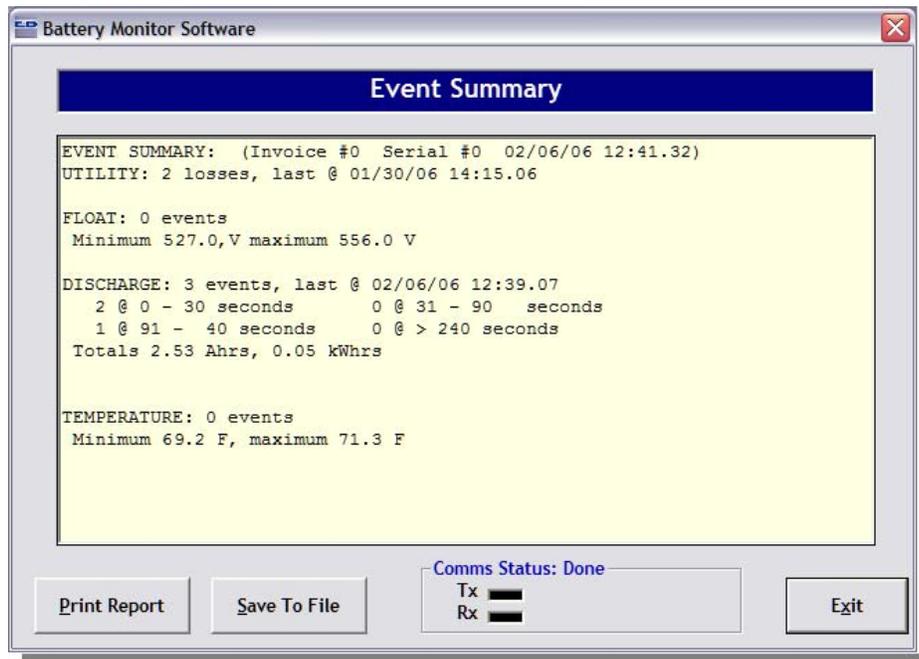
The summary will include all Utility power losses, float, discharge and temperature events that have occurred since the BCM entered service.

While the software is performing the query to the BCM, two graphical LED's will show the status of the communications between the computer and the BCM.
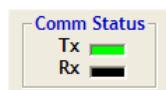
The event summary screen can also be saved to any directory on your local computer or local area network.

The "Print Report" button is used to capture this report to any printer that you select.

If you are experiencing communications problems with this option, you should note that the Tx and Rx indicators will be red in color, and "Comms Status" will show "Error", as shown here:
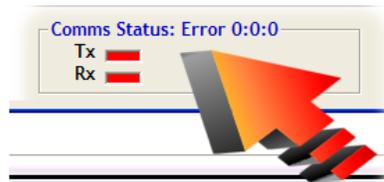
Refer to the communications troubleshooting section for this condition.

Event Records:

The event records option will launch a new window and query the BCM for the details of all technical events.

There are two options for retrieving the event detail records from the BCM. The user may either retrieve all of the data contained in the BCM or only the data starting from a selected date. When this screen is selected from the main screen, a calendar will appear as in this example:


If you would like to see all of the data, simply press the "All Records" button. If you would only like to see the details from a starting date, use the calendar and select

the day, month, and year. Then press the "Use Selected Date" button, and only data from your selected date through the present will be retrieved.

The time needed to acquire the data will vary depending on whether you are using a modem or are directly connected, and whether or not you select all data or a start date.

While the software is retrieving the data from the BCM, two animated graphical LED's will show the status of the communications between the computer and the BCM, as shown here.
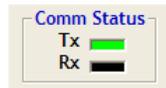
The event records can be saved to any directory on your local computer or local area network, or printed to any printer that is defined on your computer.

The columns reported are the following:

Column	Description
Rec#	The row number for the recorded event. This is a sequential number and is incremented when the next record is logged. This is not specific to a type of event and is used to number the rows in the spreadsheet. It should not be confused with the Event # described in the Event Definitions section of this document.
Event Description	A description of the event.
Date / Time	The date and time (DAT) stamp for the event.
V or T	This column displays the voltage during Float and discharge events. During Temperature events, this column will display the temperature in degrees Fahrenheit. In addition, this column displays a description for Monitor Diagnostic events.
Current	This column displays the current measured during Float and Discharge events.
Min/Max	This column displays one of the following: 1. At Batt Discharge End events, the Maximum current measured during the discharge is displayed. 2. During Float events, the minimum or maximum voltage measured during the event is displayed. Minimum voltage is displayed if the event occurred because the voltage decreased more than the Float Deviation. Maximum voltage is displayed if the event occurred because the voltage increased more than the Float Deviation. 3. During temperature events the minimum or maximum temperature measured during the event is displayed. Minimum temperature is displayed if the event occurred because the temperature decreased more than the Temperature Deviation. Maximum temperature is displayed if the event occurred because the temperature increased more than the Temperature Deviation.
Ahr	Amp Hours removed from the battery during the discharge event.
kWhr	Kilowatt Hours used during the discharge.

Table 26: Events Records Column descriptions

Event Definitions

The follow table lists all possible events the BCM Plus can record. The event number is a unique identifier for the event type and should not be confused with the Rec# in the downloaded spreadsheet.

Event #	Event	Specification	Data logged
0	Monitor Reset		Date and Time (DAT)
1	Internal Batt Volts Low [1].	<5.30V	DAT – Vbat
2	Internal Batt Volts OK. (After event 1)	>5.90V	DAT – Vbat
3	AC Power Lost.[2]	<90VAC	DAT
4	AC Power restored. (After event 3)	>100VAC	DAT
5	Monitor Diagnostic		DAT – Status code
6	Shunt Disconnected	Vshunt > 21.0mV	DAT
7	DC Voltage Disconnected	Vstring < 50V (UPS) Vstring < 20V (48V) Vstring < 10V (24V)	DAT
8	Shunt Connect. (After event 6)	Vshunt < 20.0mV	DAT
9	DC Volts Reconnected. (After event 7)	Vstring > 75V (UPS) Vstring > 36V (48V) Vstring > 18V (24V)	DAT
10	Float Event Start. (Ishunt ≥ 0)[3]	Vstring > or < NOM ±DEV[4]	DAT – Vstring – Ishunt
11	Float Event Stop. (Ishunt ≥ 0)	Vstring within NOM ± DEV/2	DAT – Vstring – Ishunt – min or max Vstring
12	Batt Discharge Start.[5]	Ishunt < DEV & Vstring < NOM-DEV	DAT – Vstring – Ishunt
13	Discharge Power Change (from start of event 12 or from last event 13. Only during event 12[6])	∆Power > DEV & |dP/dt|< 2%NOM P	DAT – Vstring – Ishunt
14	Batt Discharge End. (Information just before end of discharge.[7] Only after event 12)	Ishunt ≥ 0	DAT – Vstring – Ishunt – Ishunt max – Total Ahrs – Total kWhr

Table 27: Event Definitions (part1)

[1]The value used for low battery detect is the value measured when the utility power is off or on, whichever is lower, (under load.) This value is set to the no load measurement when new batteries are installed.

[2]The first scan after power loss is at 2.5s. After 2.5s, all parameters are scanned every 5s.

[3]Charging currents are (+) and produce a (+) Vshunt. Discharging currents are (-) and produce a (-) Vshunt.

[4]NOM and DEV are Programmable Parameters from the startup record.

[5]Conditions for discharge must exist for at least three seconds before a discharge is recorded. Discharges that occur during a utility loss are recorded when recognized.

[6]Events are recorded when the discharge power changes by the power deviation parameter and the magnitude of dP/dt is less than 2% of nominal power. The initial power reference is the power when the discharge is recorded. The new base value for future deviations is the power at the last deviation.

[7]Defined as the point where power first starts to decrease towards zero.

15	Volts Restored (Only after event 14.)	Vstring > NOM -3/4 DEV & Ishunt ≥ 0	DAT – Vstring – Ishunt
16	Temp out of Range	T > or < NOM±DEV	DAT – T
17	Temp Change (from start of event 16 or from last event 17. Only during event 16)	ΔT > DEV	DAT – T
18	Temp In Range. (Only after event 16)	T within NOM ±4°F	DAT – T – min or max T

Table 28: Event Definitions (part2)

After the grid is populated with the retrieved data, selected event types can be displayed in a graph form. Use the drop-down option box to select the event type that you would like to graph. Only those event types that have been returned by the BCM will be shown.

The 11 possible event types that can be graphed are as follows:

- **INTERNAL BATT VOLTS LOW**
- **INTERNAL BATT VOLTS OK**
- **DISCHARGE POWER CHANGE**
- **BATT DISCHARGE START**
- **BATT DISCHARGE END**
- **VOLTS RESTORED**
- **FLOAT EVENT START**
- **FLOAT EVENT STOP**

- **TEMPERATURE CHANGE**
- **TEMP OUT OF RANGE**
- **TEMP IN RANGE**

Troubleshooting Communication Problems:

The proper cable needs to be selected and installed before the communications will function. For local communications, use the cable supplied with the BCM that connects to the RS-232 port of your computer.

For remote communications using the optional modem, make sure that the BCM is connected to a standard phone line and that your computer's modem port is connected to a phone line.

Note: Only an analog phone line, as opposed to a digital line coming from a PBX, will work with the modem. PBX switches can be a source of noise on non-dedicated analog telephone lines.

If you are experiencing communications problems, you will see a message that no data was received. In addition, you will not see any animated activity on the "Comms Status", shown here:

Use this checklist for possible communications problems:

1. Are you using Windows® XP with the latest service packs? If you are unsure of this, simply press the "About" button on the main screen and select "System Information".

2. Do you have the correct communications cable attached to both the PC's communications port and the BCM?

3. Did you set up the correct communications port? Keep in mind that your computer may have more than one communications port option. If your computer has a modem, it will be a different port than the local serial port.

C&D TECHNOLOGIES, INC.